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DOE G 430.1-3

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DEACTIVATION IMPLEMENTATION GUIDE

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FOREWORD

The Department of Energy (DOE) faces an enormous task in the disposition of the nation's excess facilities. Many of these facilities are large and complex and contain potentially hazardous substances. As DOE facilities complete mission operations and are declared excess, they pass into a transition phase which ultimately prepares them for disposition. The disposition phase of a facility's life cycle usually includes deactivation, decommissioning, and surveillance and maintenance (S&M) activities.

DOE has developed four Guides to provide implementation guidance for requirements found in DOE O 430.1A, LIFE-CYCLE ASSET MANAGEMENT, specific to the transition and disposition of contaminated, excess facilities. The Guides are DOE G 430.1-2, IMPLEMENTATION GUIDE FOR SURVEILLANCE AND MAINTENANCE DURING FACILITY TRANSITION AND DISPOSITION; DOE G 430.1-3, DEACTIVATION IMPLEMENTATION GUIDE; DOE G 430.1-4, DECOMMISSIONING IMPLEMENTATION GUIDE; and DOE G 430.1-5, TRANSITION IMPLEMENTATION GUIDE. The goal of the processes described in the Guides is a continuum of hazard mitigation and risk reduction throughout the transition and disposition phases, leading to timely, cost-effective disposition of the facility.

Transition activities occur between the operations and disposition phases in a facility's life cycle. Transition begins once a facility has been declared or forecast to be excess to current and future DOE needs. It includes placing the facility in stable and known conditions, identifying hazards, eliminating or mitigating hazards, and transferring programmatic and financial responsibilities from the operating program to the disposition program. Timely completion of transition activities can take advantage of facility operational capabilities before they are lost, allowing DOE to eliminate or mitigate hazards in a more efficient, cost-effective manner. In preparation for the disposition phase, it is important that material, systems, and infrastructure stabilization activities be initiated prior to the end of facility operations.

Following operational shutdown and transition, the first disposition activity is usually to deactivate the facility. The purpose of the deactivation mission is to place a facility in a safe shutdown condition that is economical to monitor and maintain for an extended period, until the eventual decommissioning of the facility. Deactivation of contaminated, excess facilities should occur as soon as reasonable and for as many facilities as possible. In this way, DOE can apply its resources in a manner that accomplishes the greatest net gains to safety and stability in the shortest time. Deactivation places the facility in a low-risk state with minimum S&M requirements.

The final facility disposition activity is typically decommissioning, during which the facility is taken to its ultimate end state through decontamination and/or dismantlement. After decommissioning is complete, the facility or surrounding area may require DOE control for protection of the public and the environment or for environmental remediation.

S&M activities are conducted throughout the facility life cycle, including when a facility is not operating and is not expected to operate again. During these last periods of a facility life cycle, it is important to ensure that S&M is adequate to maintain the facility safety envelope during the final stages of operations through a seamless transition to the final disposition of the facility. S&M is adjusted during the facility life cycle as transition, deactivation, and decommissioning activities are completed. S&M activities include periodic inspections and maintenance of structures, systems, and equipment to ensure that, at a minimum, any contamination is adequately contained and that the potential hazards to workers, the public, and the environment are eliminated or mitigated and controlled.

The technical, managerial, and planning perspectives offered in these Guides can be equally effective in conducting activities other than transition and disposition, such as refurbishment and “cleanup” for reuse. As such, this guidance can be adapted for use at facilities that are not being declared excess.

An important objective throughout transition and disposition is to maintain an integrated and seamless process linking deactivation, decommissioning, and S&M with the previous life-cycle phases. Activities of facility transition and disposition must incorporate integrated safety management at all levels to provide cost-effective protection of workers, the public, and the environment.

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1. INTRODUCTION

1.1 PURPOSE

This Guide was prepared to aid in the development, planning, and implementation of deactivation requirements and activities at Department of Energy (DOE) facilities that have been declared excess to any future mission requirements. It is one of four Guides developed to provide guidance for facility transition and disposition activities. The other three Guides are—

- DOE G 430.1-2, IMPLEMENTATION GUIDE FOR SURVEILLANCE AND MAINTENANCE DURING FACILITY TRANSITION AND DISPOSITION;
- DOE G 430.1-4, DECOMMISSIONING IMPLEMENTATION GUIDE; and
- DOE G 430.1-5, TRANSITION IMPLEMENTATION GUIDE.

Requirements for deactivation are stated in DOE O 430.1A, LIFE-CYCLE ASSET MANAGEMENT (LCAM), which identifies the minimum requirements for disposition of an excess DOE facility. This Guide defines activities or actions that continue the process of risk reduction after seamless transition from operations to the selected disposition path. It is part of the DOE Directives System and is consistent with the principles and core functions of DOE P 450.4, SAFETY MANAGEMENT SYSTEM POLICY. Other documents that should be consulted to support the planning and conduct of disposition activities include DOE-STD-1120-98, *Integration of Environment, Safety and Health into Facility Disposition Activities*, and the Good Practice Guides associated with LCAM.

1.2 ALTERNATIVE METHODS

This Guide presents acceptable methods for implementing the deactivation requirements specified in LCAM to ensure effective and efficient management of DOE excess facilities. It does not impose additional requirements. The Department has invested substantial time and effort in developing a deactivation framework that (1) meets DOE's requirements and expectations, (2) draws on DOE's previous experience, and (3) is responsive to oversight entities. Although alternative methods and approaches to the ones discussed in this Guide may be used, a comparable amount of time and effort may be needed to evaluate the acceptability of those alternatives.

1.3 APPLICABILITY

This Guide may be applied to deactivation activities and processes at contaminated DOE facilities. "Contaminated" refers to both radioactive contamination and to hazardous-substance contamination. Both nuclear facilities and nonnuclear contaminated facilities are included in the scope of this Guide. Project personnel are expected to apply a graded (i.e., tailored) approach in planning and conducting deactivation activities at different types of facilities and with different hazard conditions.

1.4 CROSSWALK OF DOE O 430.1A REQUIREMENTS TO DOE G 430.1-3

The LCAM requirements that apply to deactivation activities are included in Table 1, cross-referenced to the sections of this Guide where they are addressed. Though the table quotes the requirements as they appear in LCAM, this Guide addresses only those requirements that apply to deactivation activities. Parallel tables in the other three LCAM Guides provide crosswalks between requirements and guidance for surveillance and maintenance (S&M), decommissioning, and transition.

Table 1. Mapping of Requirements—Deactivation.

Requirement	Where Addressed in Guide
DOE O 430.1A, paragraph 6a: DOE elements shall use a value-added, quality-driven, graded approach to life-cycle asset management.	Section 3.3, Graded Approach
DOE O 430.1A, paragraph 6g(1): Application, as appropriate, of guidelines contained or referenced in DOE-STD-1120-98, *Integration of Environment, Safety and Health into Facility Disposition Activities*.	Section 3, Deactivation Phase —General Guidance; Section 4.2.2, Step 4: Integrate Safety into the Project
DOE O 430.1A, paragraph 6g(6)(a): A method to ensure that deactivation, S&M, and decommissioning activities are appropriately planned, conducted, and documented in a manner consistent with the guiding principles and core functions of the Department's integrated safety management and facility disposition policies.	Section 3.2, Integrated Safety Management; Section 4.2, Deactivation Project Planning; and Section 4.2.2, Step 4: Integrate Safety into the Project
DOE O 430.1A, paragraph 6g(6)(a)(i): The collection of baseline data to support a physical, chemical, and radiological characterization, updated as necessary to reflect changes in facility conditions during the disposition process.	Section 4, Deactivation Phase —General Guidance, and Section 4.4.2, Step 13: Final Report
DOE O 430.1A, paragraph 6g(6)(a)(iii): A method for identifying, assessing, and evaluating alternatives for deactivating and/or decommissioning and for selecting and documenting a preferred alternative.	Section 4.2.4, Step 6: Identify and Evaluate Alternatives

Table 1. Mapping of Requirements—Deactivation (continued).

Requirement	Where Addressed in Guide
DOE O 430.1A, paragraph 6g(6)(a)(iv): An end-point process in deactivation and decommissioning planning that identifies specific facility end points and activities needed to achieve those end points.	Section 3.1, Project Management Principles— Systems Engineering; Section 4.2, Deactivation Project Planning; Section 4.2.3, Step 5: Develop Detailed End Points
DOE O 430.1A, paragraph 6g(6)(a)(v): A method for detailed engineering planning and for plan documentation to execute the preferred deactivation and/or decommissioning alternative.	Section 3.1, Project Management Principles—Systems Engineering
DOE O 430.1A, paragraph 6.g.(6).(c): The development of a final report, or equivalent document, for each deactivation and/or decommissioning project. Where deactivation and decommissioning are conducted as a single, uninterrupted activity, only one final report, or equivalent, is required.	Section 4.4.2, Step 13: Final Report
DOE O 430.1A, paragraph 6i: DOE corporate physical assets databases shall be maintained as complete, current inventories of the DOE physical assets. For real property, the corporate database is Facilities Information Management System (FIMS).	Section 4.4, Project Closeout
DOE O 430.1A, paragraph 6j: In the acquisition, operation, maintenance, leasing, and disposition of physical assets, DOE elements shall ensure that all applicable Federal, State, and local laws, regulations, and negotiated agreements are followed and that safeguards and security as well as integrated safety management requirements and policies are followed.	Chapter 3, Deactivation General Guidance

2. THE DISPOSITION PROCESS

The disposition phase of a facility's life cycle occurs after transition activities have been completed and the programmatic and financial responsibilities have been transferred from the operating program to the disposition program. After the transition activities have been completed, it is expected that hazards have been identified and either eliminated or mitigated and the facility and its contents are in stable and known conditions, thus reducing risk associated with the facility. Guidance for these transition activities is given in DOE G 430.1-5.

The LCAM Order requires a Pre-Transfer Review report for contaminated, excess facilities that are transferred from the operating program to the disposition program. The operating program completes the report prior to transfer, documenting the condition of the facility at the time of transfer. The report is intended to verify the actions taken to arrive at the stable and known condition of the facility, its systems, and contents. The Pre-Transfer Review report not only documents the existing condition of the facility but provides the receiving organization with a clear understanding of stabilization and other transition activities completed and the results that were obtained.

DOE has developed a process to address the various elements of disposition. This process includes the transition from operations to deactivation and decommissioning as well as the continuing S&M required throughout the disposition phase. It also includes S&M that may be conducted as a stand-alone activity after deactivation activities have been completed and prior to commencing decommissioning.

The flowchart in Figure 1 depicts the elements of the disposition process. It identifies the steps necessary to eliminate or mitigate any remaining hazards and to safely complete the disposition of a contaminated excess facility. The flowchart shows the system boundaries that distinguish the deactivation activities from those required both prior to and after deactivation of the facility. It also includes activities that will be completed after the closeout of all deactivation activities to prepare the facility for decommissioning or continued S&M status while awaiting eventual decommissioning.

Guidance for the deactivation activities is addressed in the remaining chapters of this guidance document. S&M activities are referenced as appropriate to deactivation activities. As previously stated, more specific guidance on S&M and decommissioning activities may be found in DOE G 430.1-2 and DOE G 430.1-4. When special nuclear materials are involved in deactivation activities, work will be performed in accordance with DOE O 470.1, SAFEGUARDS AND SECURITY PROGRAM, which provides the requirements for handling these materials.

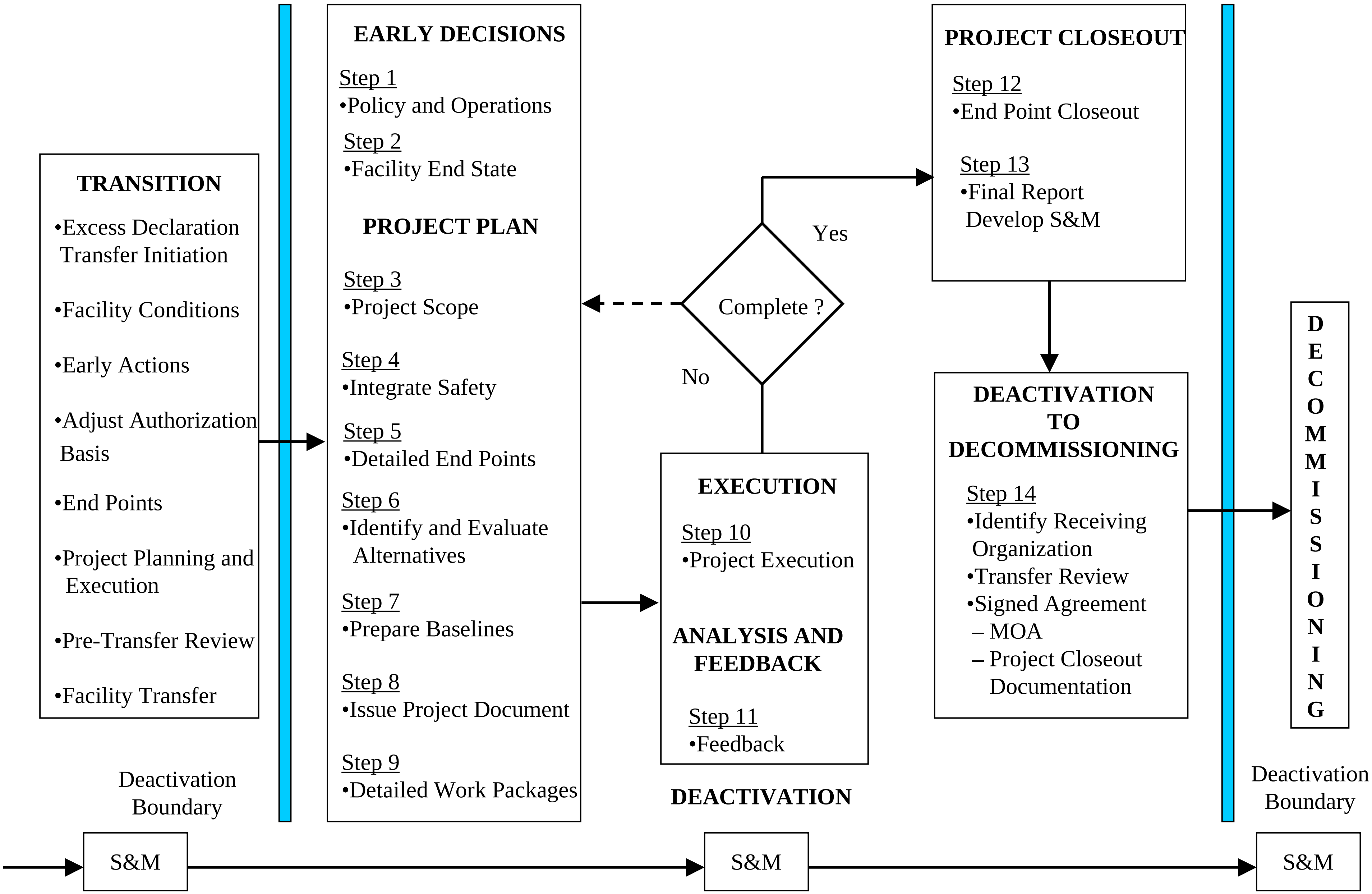

Figure 1. Disposition Process

3. DEACTIVATION PHASE—GENERAL GUIDANCE

Deactivation is the process of placing a contaminated, excess facility in a stable condition to minimize existing risks and the concomitant life-cycle cost of an S&M program that is protective of workers, the public, and the environment. Hazard elimination or mitigation must be continued during the deactivation process because hazards associated with the facility or its systems and/or contents remain even after transition activities have been completed. Deactivation end points define the characteristics of the facility when deactivation is completed and are specified to guide the scope of deactivation activities. In some instances, deactivation may not be necessary because the hazards and associated risks will be at an acceptable level until the facility's reuse or disposal is established.

As deactivation proceeds, unneeded systems within the facility are terminated, the hazards are reduced, and the S&M burden drops. This results in a stable, low-risk condition that is economically and technically practical to maintain for extended periods. Activities during this period include, for example, removal of equipment, rerouting or isolating systems, and draining and/or de-energizing nonessential systems. Deactivation may also include removing any remaining hazardous chemicals, spent fuel, and other radioactive materials/wastes; Resource Conservation and Recovery Act (RCRA) closures; and related actions. The pre-transfer characterization baseline data should be updated throughout facility deactivation. Updates of safety documentation that identify the reduction in the facility hazards are valuable to post-deactivation S&M.

S&M activities are adjusted and performed to monitor and document the presence, status, or condition of structures, systems, components, and hazards associated with the facility as deactivation activities are completed. Continuing S&M throughout deactivation ensures, at a minimum, that any contamination is adequately contained and that potential hazards to the public, the workers, and the environment are minimized. DOE G 430.1-2 provides further guidance on S&M activities throughout facility deactivation.

Since DOE has committed to conducting all work efficiently and in a manner that ensures the protection of workers, the public, and the environment, as well as to maintaining a safe shutdown configuration, this Guide references, as appropriate, the various components of DOE P 450.4 and DOE-STD-1120-98.

Nuclear material stabilization and facility deactivation activities performed during the deactivation phase are supported by and based on a defensible authorization basis, established in accordance with DOE-STD-1120-98, and commensurate with the hazards and impacts to workers, the public, and the environment. This basis includes the definition of work to be performed, any identified hazards related to the work, the associated analysis, and the administrative and/or engineering controls identified to prevent and mitigate risks associated with the hazards.

Other actions may be required during deactivation activities that are addressed in other requirement documents. It is not the intent of this Guide to offer guidance for these. The project manager and others involved with the development and/or the execution of a DOE deactivation project should be well versed in other Federal, State, and local laws and regulations, as required by LCAM, as well as requirements that address integrated safety management, conduct of operations, conduct of maintenance, radiological protection, and other requirements that are integral to the planning, development, and conduct of work.

A systems engineering approach is used throughout deactivation to ensure that essential elements are integrated at all appropriate levels. These elements primarily include safety management, as defined in DOE P 450.4 and the application of a tailored approach, as defined in DOE G 450.3-3, TAILORING FOR INTEGRATED SAFETY MANAGEMENT APPLICATIONS.

3.1 PROJECT MANAGEMENT PRINCIPLES—SYSTEMS ENGINEERING

The LCAM Order requires that a method for detailed engineering planning and plan documentation be used to execute the preferred deactivation alternative. DOE has defined deactivation end-points methodology as an acceptable method for meeting the requirements for detailed engineering planning. Further guidance regarding deactivation management and end-point management is provided in Chapters 2 and 3 of *Facility Deactivation— Methods and Practices Handbook*, DOE/EM-0318, (Revision 1, dated 9/10/99). Although DOE/EM-0318 primarily discusses the end-point methodology relative to deactivation, it is important to recognize that these acceptable methods are directly applicable to and can be used as the systems engineering method for the implementation of transition and stabilization activities.

Deactivation end-points methodology is a formal project management approach that presents proven systems engineering concepts and tools to be used in the planning and implementation of deactivation projects. Specifying end points is the key to planning, implementing, measuring and knowing when a deactivation project is complete. Specifying and meeting end points is a systematic, engineering way of proceeding from an existing condition to a stated final set of conditions in which a facility is safe and can be economically monitored and maintained until final decommissioning. The end-point method is a way to translate a broad mission statement to explicit goals that are readily understood by engineering and crafts personnel who implement the work. More detailed discussion and implementation guidance on end-points methodology is provided in Section 4.2.3.

Project management envelopes the entire deactivation process, including planning, design, execution, and end-use activities. A clear understanding of these phases enables greater control of Departmental resources in achieving the deactivation goals. Using a project management system, described in the LCAM Good Practice Guides, assists in the successful completion of each phase of a deactivation project, from facility assessment, through technical engineering, to the execution of the project tasks. These project phases generally occur in sequence. However, a continuous feedback system must be implemented to improve the quality of the tasks performed and to ensure that the safety management mechanisms address the industrial and radiological hazards experienced at each phase of work.

The purpose of deactivation project management is to establish management intentions and a set of objectives that results in a largely passive facility that can be maintained and monitored at minimal risk and cost. A deactivation project plan specifies the deactivation work to be done to achieve the project objectives by establishing the project's requirements and describing how the project will be accomplished. (See Section 4.2.)

The first step is to define the top-level deactivation objectives. These objectives, which apply to all deactivation activities, are as follows.

- Protect workers, the public, and the environment by establishing a low-risk facility status.
- Facilitate low-cost surveillance and maintenance after the facility is deactivated.
- Facilitate ultimate decommissioning work.
- Comply with regulations and requirements, including administrative requirements.
- Fulfill commitments to stakeholders.

3.2 INTEGRATED SAFETY MANAGEMENT

The DOE policy covering incorporation of a safety management system into management and work practices is identified in DOE P 450.4. The policy identifies six components in a safety management system that facilitate the orderly development and implementation of safety management throughout the deactivation of an excess facility. These components are as follow.

- The **objective** is to ensure that the overall management of safety functions and activities becomes an integral part of mission accomplishment in protecting the worker, the public, and the environment.

- The **guiding principles** are the fundamental policies that guide actions, from development of safety directives to performance of work. These include the delineation of roles and responsibilities, competence levels, balanced priorities, identification of safety standards and requirements, hazard controls tailored to the work being performed, and operations authorization.

- The **core functions** are to define the work, analyze the hazards, develop and implement hazard controls, perform the work within the controls, and provide feedback and continuous improvement.

- **Integrated safety management mechanisms** define how functions are performed. These mechanisms are based on DOE directives, policies, and procedures to identify and analyze hazards; perform safety analyses; set safety standards; and document these mechanisms, such as the Health and Safety Plan, Safety Analysis Reports, Chemical Hygiene Plans, and Process Hazard Analyses.

- **Responsibilities for integrated safety management,** appropriate to the mechanisms used, must be clearly defined to satisfy each safety management principle or function and to ensure establishment of the associated approval authority.

- **Implementation** involves specific definition of work and planning, hazards identification and analysis, definition and implementation of hazard controls, performance of work, development and implementation of operating procedures, and monitoring and assessment of performance for improvement.

The major mechanism for integrating safety and health into deactivation efforts is the work planning process during which existing safety documentation is reviewed and evaluated, deactivation activities are identified and evaluated against existing controls, and modifications to controls are identified as required by the new activities. The safety documentation of an older facility, including worker safety and health aspects, often falls short of today's standards and/or requirements. Worker safety and health considerations, comparable to or exceeding the levels demanded by the Occupational Safety and Health Act (OSHA), must be incorporated into revisions of, or supplements to, such safety documentation. Existing safety documentation from the facility's operational phase is used as the basis for deactivation project safety documentation. Revisions, comparisons, crosswalks, and other evaluation techniques can be used to determine which deactivation actions may be covered in existing documentation and which actions require supplemental coverage. Such evaluation efforts, especially if performed by those who know the facility well, are more cost effective and time efficient than preparation of new safety documentation.

Worker involvement in all levels of safety/hazards analyses required for the planning and execution of deactivation tasks is key to making all elements of deactivation efficient and satisfactory. This involvement also helps in providing management with a higher level of assurance that workers will participate willingly and enthusiastically in the performance of those activities required for facility deactivation.

3.3 GRADED APPROACH

LCAM requires the "graded approach" to the application of requirements to a particular project, activity, or facility. The "tailoring approach" defined in DOE G 450.3-3 is an acceptable method of complying with this requirement. DOE G 450.3-3 demonstrates that tailoring is integral to the integrated safety management system. Tailoring is appropriate for all steps in facility deactivation.

Tailoring allows project managers to choose from among a variety of engineering and administrative controls that provide adequate protection for workers, the public, and the environment during the performance of work. Tailoring of higher-level contractual and project agreements enables contractors to establish general standards for work. Individual tasks are tailored so that each task has controls that fit the specific work and hazards associated with it and that are consistent with higher-level performance expectations.

Tailoring permits consideration of differences between facilities and provides a means to determine the extent to which actions are appropriate for a particular facility (or portions thereof). The depth of detail required and the magnitude of resources expended for a particular management element is commensurate with the relative importance of that element to safety, environmental compliance, safeguards, and security; the magnitude of any hazard identified; programmatic importance; financial impact; and/or other facility-specific requirements. For projects for which no logical delineation between deactivation and decommissioning exists, the requirements are integrated to serve the overall project and completion objectives. In doing so, planning considers the possibility of future changes to priorities and identifies the conditions (end points) where a project may be safely and efficiently slowed or accelerated, if it becomes necessary to do so.

Tailoring is cost effective because it does not demand a high level of analysis and/or planning for simple jobs already covered in established procedures. Worker involvement, as stated earlier, has also proven to be cost effective because these employees often have spent many years performing tasks during operations, and they may have a good understanding of the safety and performance requirements of the deactivation activities.

Tailoring the integrated safety management system offers a means to grade activities and processes to different hazards associated with individual facilities. Tailoring is used to scale expectations and acceptable performance to the needs of the site, activity, facility, or work to be performed. When applied to the deactivation objectives listed in Section 3.1, tailoring promotes a work management system that is safe, efficient, and cost effective.

4. THE DEACTIVATION PHASE—PROCESS GUIDANCE

4.1 EARLY DECISIONS

Some hazards and associated risks remain after transition activities have been completed. As a result, many strategic choices need to be made early in the deactivation phase. These early decisions address policy and operational issues at the onset of the deactivation project and lead to a well-defined end state for the project. These decisions also help facility managers define the work scope that can be prudently undertaken before the formal deactivation plan is completed. These early decisions are expected to remain valid throughout the subsequent planning and execution steps. However, because changes in facility condition and regulatory requirements can occur, these decisions may need to be reevaluated periodically, either formally or informally, as deactivation work progresses. These early decisions are shown as Steps 1 and 2 in the deactivation process and are discussed below.

4.1.1 Step 1: Policy and Operational Decisions

Policy and operational issues that apply to facility deactivation are identified as early as possible to ensure the deactivation tasks can be planned and executed as effectively as possible. Examples of policy and operational issues that need to be addressed are listed below:

- Policy issues
  - Organizational responsibilities after completion of deactivation.
  - Post-deactivation disposition path (e.g., extended S&M or immediate decommissioning).
  - Future uses of the facility.
  - Safeguards and security requirements.
  - Immediate demolition in place of deactivation.
  - Disposition path for remaining radiological and hazardous materials.
  - Material interim storage needs.
  - Goal for the appropriate reduction of hazards and modification of the safety basis, consistent with existing and end-state conditions.

- Operational issues

  - Identification of personnel with operational expertise.

  - Continued elimination or mitigation of hazards.

  - Safeguards and security implementation plan.

  - Quickest means of reducing S&M resource burdens during deactivation.

  - National Environmental Policy Act (NEPA); RCRA; Comprehensive Environmental Response, Compensation, and Liability Act; OSHA, etc. requirements.

  - Heating, ventilation, lighting, and other service requirements after deactivation.

  - Projected structural integrity of the facility during post-deactivation S&M.

Decisions related to these issues that constrain, dictate, or otherwise affect detailed deactivation planning must be made as soon as possible. Other issues deserving consideration in the early decision process include—

- Establishment of the overall deactivation end state of the facility.
- Identification of any facility-specific commitments.
- Identification of deactivation tasks that are required regardless of the detailed end points.
- Evaluation of alternatives for deactivation actions (re-engineering).

When possible, early decisions should be initiated before the deactivation process formally begins. Advance efforts for the major decisions often are needed, based on the characterization findings in the Pre-Transfer Review report. To meet the top-level objectives, some deactivation or stabilization (if required) tasks may begin before detailed facility end points are specified. When deactivation is initiated before detailed end-point criteria have been established, an assumed, realistic, overall facility deactivation end state should be identified so that prudent planning can take place.

4.1.2 Step 2: Facility End-State Decision

The deactivation end state represents the agreed-upon facility condition that is to be achieved after completion of the deactivation effort. This condition is the ultimate goal of deactivation and is characterized by a safe facility configuration that can be maintained until decommissioning is feasible. Safety and health considerations are a major concern and drive the end state and the end-point definitions.

An excess facility's expected condition at the completion of deactivation should be stated as that facility's deactivation end state as early as possible in the deactivation phase. This provides a basis for proceeding with planning for early tasks and completion activities. For example, the conditions to be established can vary considerably if a facility is to be decommissioned immediately after deactivation, contrasted with being placed in a state in which S&M activities may be required for an extended period prior to the eventual decommissioning. Therefore, the deactivation end state includes decisions on whether the facility will be—

- used by the current responsible DOE office after deactivation,
- placed in an extended S&M period, or
- decommissioned and/or dismantled immediately after deactivation.

The deactivation end state also identifies which organization is intended to assume management and financial responsibility upon completion of deactivation.

4.2 DEACTIVATION PROJECT PLANNING

As discussed previously, a clear set of facility-specific objectives needs to be defined and agreed upon early in the project to ensure a cost-effective, technically efficient deactivation process that is grounded in, and bound by, a defensible safety and technical basis. This definition is required to translate high-level deactivation goals into identifiable objectives to be achieved. By proceeding from a common set of top-tier goals, a consistent and systematic approach can be implemented at facilities undergoing deactivation.

The purposes of the deactivation project planning process are to communicate the objectives, requirements, and constraints to the project organization and to document how the deactivation project is to be carried out. The output from the planning process is documented in a deactivation project plan. The deactivation project plan identifies specific activities that must be done to achieve the end points and the overall deactivation end state. It also identifies methods for the conduct of work. The intent of a project plan is to describe how the deactivation project will be managed and to communicate summary-level scope, cost, and schedule information.

Deactivation will be appropriately planned, conducted, and documented in a manner consistent with the guiding principles and core functions of DOE’s integrated safety management policies. To ensure this, the project plan will be developed in accordance with the principles of integrated safety management identified in DOE-STD-1120-98, Section 3.0, “Integrated Safety Management System.” Appendix C of the referenced Standard, “ISMS Performance Expectations,” provides information that may be helpful to verify that the project plan adequately addresses integrated safety management considerations. Other guidance may be found in Section 3.2 of this Guide and is discussed further in Section 4.2.2.

The project plan consists of two distinct but interrelated parts: (1) the project plan document and (2) the supporting appendixes. The project plan document provides the strategies and methods for managing the project. It includes an overview or summary of project scope, cost, and schedule. The project plan document is updated as the detailed supporting documentation is developed. A suggested project plan outline is as follows:

1. Introduction. Describes the purpose and overview of the plan. It outlines, in summary form, the strategy of the project plan versus details in the supporting appendixes that follow.

2. Project Objectives. Describes the purpose of the deactivation project and explains its driving objectives, which are covered in Section 3.1 of this Guide.

3. Project Scope. Describes the facilities (addressed in Section 4.2.1 of this Guide) that will be deactivated and the major actions which comprise the project.

4. Project Organization. Describes the project organization and all functional relationships and discusses the roles and responsibilities with respect to accomplishing the project objectives.

5. Project Management and Control. Describes the systems and processes to be used to manage and control all aspects of the project (e.g., cost, schedule, scope). This section of the project plan document also includes a process for issue resolution and technical decision making.

6. Project Baseline. Contains a roll-up summary of the work breakdown structure, schedule, proposed milestones, and cost estimate. These subjects are addressed in more detail in Section 4.2.5 of this Guide.

7. End Points. Describes the process used to develop the end points. Section 4.2.3 of this Guide addresses the development of end points for a deactivation project.

8. Quality Assurance. Describes the policies and procedures to be used to meet quality assurance objectives.

9. Regulatory. Provides an overview of the deactivation project regulatory drivers and the proposed approaches to ensuring compliance.

10. Safety and Health. Provides the safety basis and the strategy and methods to be used for evaluating the hazards associated with the project activities. The strategy includes integration of worker safety and health issues as well as protection of the public and dislocated site workers. Incorporating safety into the deactivation project is addressed in detail in Section 4.2.2 of this Guide as well as in DOE-STD-1120-98, Section 3.0, "Integrated Safety Management System."

11. Communications. Outlines a plan for public and stakeholder outreach and involvement and provides the proposed communications objectives and methods. Section 4.2.4 of this Guide discusses the need for open communications during the deactivation project.

12. Project Risk. Provides an outline of the method to be used in performing a project risk assessment.

The supporting appendixes to the deactivation project plan provide the detailed documentation for application and implementation of the project strategies. The supporting appendixes also provide the detailed cost and schedule data. These appendixes are used to provide guidance to project staff for day-to-day management of the project and are developed, maintained, and approved by the deactivation contractor. The following topics and their descriptions are suggested as supporting appendixes to be included as part of the project plan.

- Work Management. Describes the work management system and procedures to be used in the performance of project objectives.

- Current Fiscal Year Execution Plan. Establishes the scope, cost, and schedule for the project integrating the deactivation activities defined by the end-point document. The current fiscal year execution plan is a site-specific document and therefore may be identified differently (e.g., multiyear program plan, annual operating plan, project plan). Its intent is consistent across the DOE complex in specifying the project milestones and deliverables and forming the project baseline in terms of cost and schedule. It serves as the vehicle for obtaining DOE approval of the planned work scope.

- Schedules. Provides the top-level one or two project baseline schedules and the network diagram. The project baseline schedule is included in the site’s current fiscal year execution plan. Detailed working schedules (from which the baseline is developed) are maintained and controlled by the project team.

- Work Breakdown Structure Dictionary and Basis of Estimate. Describes the key assumptions and work scope for each deactivation activity included in the baseline schedule.

- Cost Estimate Work Sheets. Provides a compendium of the work sheets used to estimate resources and materials required to implement the schedule. The work sheets constitute the project estimate and provide the basis for the current fiscal year execution plan.

- Schedule Preparation and Change Control. Describes the schedule preparation methodology and best management practices. This appendix also identifies the procedures for schedule maintenance, change control, and status reporting.

- Configuration Control. Describes the configuration control practices to be used for the project. It also identifies the compliance approach with the site configuration control procedures and how waivers or exemptions will be approved and documented.

- Technical Baseline Development and Control. Describes the relationship of systems engineering to preparation of the technical baseline. The best management approaches for development of technical baseline documentation should be described here.

- Project Metrics. Identifies the performance measures to be used to communicate project performance.

- End-Point Document. Contains the facility-specific material stabilization and facility deactivation end-point criteria and the agreed-upon end points. These end points define the work that will be performed during the deactivation project, which is integrated and presented in the current fiscal year execution plan.

- End-point Closure Methods and Practices. Provides the acceptable methods and procedures for end-point closeout (addressed in Section 4.4.1 of this Guide) to ensure that a consistent and defensible end-point closure is achieved.

- S&M Plan. Outlines the facility-specific S&M activities to be performed in conjunction with the deactivation project activities to ensure the facility's safety envelope is maintained in a safe, efficient, compliant, and cost-effective manner. This plan includes the key interfaces with project activities, the phase-out of pre-deactivation S&M, and the phase-in of post-deactivation S&M as required. The post-deactivation S&M is used and maintained until decommissioning activities begin.

- Health and Safety Documentation. Provides detailed implementation procedures for the safety and health plan identified in the first part of the deactivation project plan.

- Project Risk Assessment. Provides an evaluation of the project baseline risks that does not include safety and health risk. The technical, cost, and schedule baselines should be evaluated with regard to risk factors such as technology, interfaces, stakeholder involvement, worker issues, etc. This assessment is a combined effort between the contractor and the customer.

- Radiological Controls. Describes the ALARA (as low as reasonably achievable) implementation and radiological exposure/dose reduction practices. This appendix includes projected radiological dose estimates and the actual measured doses. It also defines the key radiological control management indicators.

- Waste Management. Identifies the projected wastes by type and volume and captures the waste generation actuals. Waste management, pollution prevention, and waste minimization practices and methods are also identified. Other regulatory aspects may be included as appropriate.

- Closure Plan. Provides detailed actions to be completed during deactivation to accomplish the closure of specific systems in compliance with regulatory requirements.

During development of the deactivation project plan, facility conditions and/or business situations are identified that necessitate the inclusion of more than the usual plan elements. The deactivation project plan should include additional appendixes, other than those previously suggested, which address the following on an as-needed basis and as agreed upon by management:

- Separate identification of costs to operate and maintain the facility, exclusive of direct deactivation tasks. (The costs of deactivation activities are identified in the deactivation project plan.) This allows illustration and analysis of the deactivation project's mortgage-reduction achievement.

- Resource needs for the deactivation of existing facilities. An important aspect is the transformation of the existing facility's organizational structure from what may be primarily a production (continuous level of effort) organization to a project organization that moves toward decreasing resource needs.

- Technical integration with other projects and activities. For deactivation of existing facilities, the primary emphasis is on physically connected facilities and service systems outside of the project scope.

- Project flow or logic diagram for purposes of identifying important decisions that affect the project performance, their dependencies, and results of the options to be considered.

- Stakeholder involvement and agreements that affect worker and public health and the conduct or results of deactivation work.

- Environmental activities and documentation, in particular, where prior facility-specific agreements are to be incorporated into the deactivation work and/or where deactivation activities potentially have a substantial environmental impact beyond the current environmental operating basis.

Together, the project plan document and the supporting appendixes form the "body of knowledge" for the project and provide a useful working tool throughout the life of the project. The level of detail in addressing specific issues should be appropriate to the nature of the facility and the scope and magnitude of the deactivation project (i.e., tailoring). The following sections describe the steps to be taken during the deactivation planning process. Further guidance regarding deactivation management and deactivation work planning is provided in Chapters 2 and 7 of DOE/EM-0318.

4.2.1 Step 3: Determine Project Scope

The facility identification and boundaries of a deactivation project normally include the facility and its associated supporting facilities, offices, and infrastructure. However, a deactivation project could also be developed around a particular shutdown process (or operation) that may occur in several different facilities (or areas). The project management team should consider combining similar processes (or operations) in the facilities into one project.

4.2.2 Step 4: Integrate Safety into the Project

Protection of the worker, the public, and the environment during deactivation is of paramount importance. It is the direct responsibility of the project management team to ensure that safety standards and requirements are in place and are integral parts of planning and implementation. During deactivation projects, workers, for example, are potentially exposed to hazards and risks, including occupational/industrial, chemical, and radiological. The risks can be similar to those experienced when the facility was in operation but can often be quite different since the tasks involved in deactivation may be different from those performed during operation. DOE-STD-1120-98 provides further guidance for establishing a set of safety standards applicable to facility disposition activities.

Integrated Safety Management. In accordance with DOE P 450.4 and DOE-STD-1120-98, the identification of facility hazards and deactivation tasks will be integrated into the work planning process to ensure that all existing hazards are identified, hazards associated with deactivation activities are recognized, and appropriate controls are established. This analysis is iterative throughout the deactivation process.

The overlying objective is to deactivate the facilities in a safe and hazard-free manner—both for the employees conducting such work and for the public and the environment—by reducing the likelihood of release and exposure to the numerous hazards that may be present. To accomplish this objective, the project team weighs the identified hazards and mitigation options against the safety and health standards that apply to those hazards and the work to be performed. The project team, and any involved stakeholders, determine the extent of the safety standards applicable under safety and health requirements from Federal, State, local, and Departmental Orders and Standards and nationally and internationally recognized consensus standards. A consensus should be reached on the applicability to the project.

This group also determines the adequacy of these requirements to protect the workers, the public, and the environment. Once agreement has been reached, the safety and health standards are incorporated into the work tasks.

Scope of Hazards. The identification of hazards in the facility is a critical element in future planning for the end state of the facility. Hazards are evaluated against operational system, materials handling, safety and health, and regulatory requirements. A preliminary hazard analysis is conducted commensurate with the adequacy of existing safety documentation, the extent of hazards, and the nature of the work activities to be performed.

Accurate facility characterization information is a critical element in understanding the hazards. The information obtained from the Pre-Transfer Review report, which was prepared during the facility's transition, should be commensurate with the existing hazards at the time of transfer to the disposition program. This report is a useful source of information; however, more up-to-date information may need to be obtained to ensure the current hazards at the facility are well understood.

The establishment of a multidisciplinary team is recommended to evaluate the hazards. This team provides a more comprehensive hazard analysis with fewer opportunities to overlook critical items. Team-member disciplines should cover areas such as environmental, electrical, structural, mechanical, and nuclear engineering; safety and health experts; and operational staff from the facility. Pending the options considered for deactivation, the teams may include persons from areas such as safeguards and security, transportation, and regulatory compliance.

Authorization Basis. Deactivation activities (including any remaining material stabilization) must be supported by and based on a defensible authorization basis. This basis includes the definition of work to be performed, any identified hazards related to the work and the associated analysis, and the administrative and/or engineering controls identified to eliminate or mitigate risks associated with the hazards.

Worker and public safety and health must be protected from adverse impacts associated with deactivation activities. Several DOE and external safety and health directives, which describe the development or updates of documentation, provide guidance for the declaration of how this protection should be accomplished. DOE-STD-1120-98 provides guidance on the appropriate integration of such guidance.

Safety documentation serves as a key document for authorizing deactivation of a facility. The type and extent of hazard baseline documents varies depending on the deactivation activity's work scope and hazards but typically include a combination of either a Safety Analysis Report, Basis for Interim Operation, Technical Safety Requirements, or other types of documented analysis and work packages used to plan and control work tasks. Existing documentation (such as a Safety Analysis Report written for operations) is evaluated to determine whether it is adequate to meet the latest operational or deactivation requirements and whether the facility configuration is well documented for the remainder of the facility's life cycle. Typically, when an existing DOE facility Safety Analysis Report does not meet the requirements of DOE 5480.23, NUCLEAR SAFETY ANALYSIS REPORTS, a Basis for Interim Operation is prepared as an interim hazard baseline document until the Safety Analysis Report can be upgraded. DOE-STD-3011-94, *Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans,* provides guidance for preparing a Basis for Interim Operation.

A Safety Analysis Report or Basis for Interim Operation typically serves as the hazard baseline document for Hazard Category 2 or 3 nuclear facilities, as required by DOE 5480.23, and other equivalent documents serve as the baseline for hazardous chemically contaminated (nonradiological) facilities. These documents are the principal safety and health documents that ensure worker hazards are identified, evaluated, controlled, and communicated. This documentation is used to prepare work packages for the worker before a given activity begins. They also provide a baseline or inventory of hazards against which unforseen hazards can be evaluated.

Process Systems Evaluations. Evaluation of the critical systems needed to maintain the facility at the deactivation end state must be completed in order to plan work effectively. This evaluation helps ensure the necessary configurations are maintained in a safe and secure manner. A history of the operational systems should be reviewed to investigate past occurrences or accidents, performance constraints of the system, and anticipated life-cycle issues that may require replacement of system components before deactivation or decommissioning can be accomplished.

Materials Hazards Evaluations. One of the major drivers for deactivating an excess facility is to place it in a low-risk state with minimum S&M requirements. Some of the first S&M costs that can be reduced are those related to surveillance of stored hazardous and radioactive materials and wastes. There may be situations where the facility contains these stored materials and wastes even after the completion of transition activities. Disposition paths may not yet be available or agreements prior to facility transfer may have been made between the operating program and the disposition program. Removal of these materials and wastes should be one of the first decisions made prior to conducting any other deactivation activities.

Finding an alternative use for some materials may be better than waste disposal. This option should be considered regardless of returned monetary value. A key factor in the evaluation is the impact a waste designation may have on management of the material. Long-term regulatory control and the costs associated with maintaining facilities for treatment and disposal, including maintenance of documentation, should be evaluated.

Prioritization of Facility Hazards. Prioritizing facility hazards is an important step in developing the specific work packages. As the level of detail of available information improves during the planning phase, improvement to the levels of work to be performed can be made. As the improved work scope develops, the ability to modify the priority for execution of near-term tasks improves. This may also assist sitewide prioritization during deactivation of multiple facilities.

Identification of Standards and Requirements. Many requirements and standards are applicable to a deactivation project, ranging from materials accountability to facility integrity. A necessary and sufficient set of standards is one that meets the performance expectations and goals for the work and contains only the standards necessary for the given work activities and the associated work hazards under consideration. This process consists of the following actions:

- initiating the necessary and sufficient closure process for each project;
- compiling or developing a necessary and sufficient set of standards;
- incorporating these standards into the work planning; and
- evaluating work performance against these standards.

As the deactivation work progresses, it is necessary to evaluate the completed actions and reconsider the standards decided upon during the work planning. Based on the hazard level remaining in the facility following completion of work, changes may be made to improve the effectiveness and control of the remaining deactivation activities.

Implementation of Controls. After analyzing the hazards, defining the work scope, and determining the standards and requirements, sufficient detail exists to complete each work scope task. Control methods are implemented, such as significant check points in the work planning and performance process, to ensure that the activities are completed in a safe and timely fashion.

Approach to Meeting Requirements. Prior to the physical start of deactivation, the level of detail should be sufficiently high to determine detailed end-point specifications, an authorization basis to perform the work safely, work package specifications, and detailed cost and schedule estimates. By incorporating this information into the project plan, the project team ensures that configuration controls have been established for the level of work to be performed.

Before validating and initiating the deactivation project, and after establishing and approving the baselines, the project team, especially the project manager, should implement the appropriate controls on those project areas that were identified as high risk. The project manager or team can control a project by regulating the degree of detail, frequency of feedback, accuracy of feedback, timeliness of feedback, and formality of feedback based on the unique project characteristics and complexity.

4.2.3 Step 5: Develop Detailed End-Points

A fundamental premise of project management for deactivation is to identify when the deactivation project is complete. Specifying the end-points for the facility's spaces, systems, and major equipment is the key to identifying when a facility has been deactivated. End-point specifications for the entire facility are used during and/or after implementation:

- as input for scheduling and cost estimating;
- to create detailed work plans for each space and system in the facility;
- to document bases for performance-based contracting or out-sourcing of work, where practical to do so;
- to demonstrate conformance to agreements negotiated with third parties who have a legitimate stake in the condition of the facility after deactivation; and
- to show compliance with both local and Federal regulations.

A consensus on the desired end points helps to reduce scope, cost, and schedule changes and ensures an improved level of satisfaction by stakeholders.

Since identifying the end points is an integral part of deriving the project work breakdown structure, schedule, and budget, end-point planning and specification should be initiated as soon as possible. Specifying end conditions is the first part of the end-point planning process. Facility end points are derived for plant areas, structures, systems, and equipment. The specifications should be quantitative, where possible, and in all instances must be explicit.

Specifying and achieving end points is a systematic engineering method for progressing from an existing condition to a desired final set of conditions in which the facility is safe, shutdown, and can be economically maintained and monitored. An end-point method is a way to translate broad mission statements into explicit goals that are readily understood by engineers and the crafts personnel who perform the work. The method is a systematic process that can result in hundreds, to a thousand or more, explicitly stated conditions to be achieved.

The detailed specification and the actual end points achieved will undoubtedly vary from facility to facility across the DOE complex. Variations are expected because of the differences among facilities with respect to previous mission requirements, equipment and systems, containment, degree of contamination, ability to isolate the contamination, facility environs, projected ultimate disposition, and a host of other factors. Regardless of variations in conditions to be achieved, the methods used to decide and specify end points are fundamentally similar.

Several guiding principles form the foundation of the end-point process:

- The decision to specify an end point needs to be driven by, and clearly linked to, top-tier program objectives.

- End-point decisions are integrally linked to decisions (and constraints) on resources and methods. If a proposed end point is not economically feasible, it will only be specified if mandated by law, applicable regulation, or formal agreement.

- End-point decisions may consider, but should not be driven by, decommissioning presumptions.

- Defense-in-depth as a fundamental safety approach is used to determine the end-point condition of the deactivated facility. As applied here, defense-in-depth involves three layers of protection: (1) elimination or mitigation of hazards, (2) effective facility containment, and (3) facility monitoring and control. In this context, the concept of reducing risk to acceptable levels can be applied.

- Successful end-point development requires "ownership" by all affected organizations, including the planners, the deactivation work force, and the receiving organization.

- Work teams in the field need clear, quantitative completion criteria. End points must be established up front, must meet the completion criteria, and be practical and achievable.

- End-point development is an iterative process. Most end-point decisions can be made during the planning stages early in the project; however, some end points will have to be revisited as deactivation proceeds.

- A deactivation project is intended to be done in the short term; therefore, it must be possible to achieve the objective with current knowledge. That is, a reasonable schedule probably would not allow for preliminary research as a prerequisite for activities to achieve an end point.

These guidelines should be used when selecting the end-point method, setting up criteria, and specifying detailed end points. The use of a tailoring approach in the development of the facility end points is appropriate to differentiate between complex facilities with process systems and/or significant hazards and those with relatively simple buildings that are not substantially contaminated and do not have complex equipment or systems. DOE considers the hierarchical end-point or checklist end-point methods described in Chapters 5 and 6 of DOE/EM-0318 to be acceptable methods for deriving end-point specifications.

4.2.4 Step 6: Identify and Evaluate Alternatives

As previously stated, the overall mission of deactivation is to achieve a safe shutdown of the contaminated facility, reduce risks, and attain a low-cost S&M until the eventual decommissioning of the facility. This includes identifying, assessing, and evaluating alternatives and end points for deactivation activities which support both the deactivation and the decommissioning end states.

The alternatives and end points, and the methods for developing them, are included during the deactivation planning process.

An important part of this step in the deactivation process consists of compiling all pertinent information contained in the Pre-Transfer Review report, end-point determinations, and any other analyses or reviews. This information provides the basis for identifying deactivation alternatives and selecting the most appropriate alternative with input from the public, as appropriate.

The identification and evaluation of deactivation alternatives along with the end points determines the extent of action to be taken to deactivate the facility (or portions thereof). Following identification of candidate alternatives, data from several interrelated activities and incorporation of integrated safety management provides the information necessary for the selection of the preferred alternative, including:

- characterization results and documentation from prior transition activities (augmented as necessary);
- the need to continue maintaining adequate controls for worker safety while conducting deactivation;
- risk assessments that support the safety analysis and are proportionate to the potential threat resulting from actual conditions in the facility; and
- analyses of hazards and identification of mitigating measures associated with each deactivation alternative.

Information on factors that could influence the selection of deactivation alternatives (e.g., potential future use, long-range site plans, facility condition and potential health, safety and environmental hazards) are contained in the Pre-Transfer Review report. A tradeoff analysis to systematically analyze alternative options is used to compare characteristics such as:

- life-cycle cost,
- schedule,
- worker exposure,
- waste generated, and
- discharge of hazardous material(s) to the environment

Examples of three types of cost-benefit evaluations to choose among deactivation end-points is provided in Chapter 9, Section 9.1.2, of DOE/EM-0318. These analyses greatly enhance the process of identifying, assessing, and evaluating alternatives and the selection of the preferred alternative.

Sound engineering must be incorporated in the planning process to ensure the alternative actions identified meet the project objectives, the environmental issues associated with the deactivation are recognized and assessed, and there is a support structure for the preparation of any required environmental documentation.

Using the information gained in this step of the deactivation process, DOE formulates and evaluate deactivation alternatives and select the preferred alternative. The analysis of deactivation alternatives is to be commensurate with the scope and complexity of the deactivation project, consistent with the application of tailoring.

Communication and involvement with stakeholders should also be actively maintained as needed throughout the development of the project execution alternatives and the selection of the preferred deactivation alternative. Constant communication during alternatives development allows for incorporation of requirements, concerns, and expectations into the project execution alternatives. Open communication during the development of the project execution alternatives facilitates consensus on which alternative will be pursued.

The final decision in the selection of the deactivation action is documented. The decision takes into account all analyses of deactivation alternatives and the comments received on the alternatives. The documentation on the selection of the preferred alternative includes the rationale for the selection.

4.2.5 Step 7: Prepare Baselines

The project baseline is a quantitative expression of projected costs, schedule, and physical progress of a deactivation project. Projects are approved and resources are allocated based on the expectation that risks and hazards will decrease and overall costs will be reduced. Cost and schedule baselines are a base or standard for objectively measuring the technical achievements and expenditure of resources. Baselines increase in the level of detail as the deactivation project progresses. Only high-level schedule parameters are identified initially, and the total baseline is provided after the detailed deactivation project plan is developed. Baseline development for each deactivation project is unique and depends on the specific hazards and risks associated with the facility. However, the process is iterative in nature and proceeds in the following sequence:

1. Performance Baseline. The performance policies for a deactivation project are the first project expectations generated and are documented in the performance baseline. This baseline presents a quantitative expression of the physical transformation the facility will undergo (i.e., decontamination achieved, remaining hazardous materials removed, etc.) and provides an objective reference for the measurement of progress toward the project's end points and eventual deactivation end state.

   The performance baseline is developed after the existing conditions at an excess facility are identified. This allows the project manager to understand the existing hazards, risks, liability, and costs, associated with the facility. The desired deactivation end state also identifies and is a quantitative description of the level of contamination, amount of hazardous materials, etc., in the facility when the deactivation project is completed.

2. Cost and Schedule Baselines. After the performance baseline is determined, the sequence of actions and the associated costs necessary to achieve the desired end points are identified. Cost and schedule baselines are evolutionary in nature. During the first phase of development of the deactivation project plan, an initial total cost estimate can be

determined using parametric cost-estimating techniques. As the plan is finalized, a detailed funding profile is developed, a detailed cost estimate is produced, and an activity-based cost estimate is associated with the detailed design. The budget developed for the deactivation project plan should refer to the cost estimate.

3. Technical Baseline and Milestones. The technical baseline provides clear definition of the deactivation project's scope and the technical approach that was selected for the project. It is used to capture the results of the engineering effort which converted the functional objectives and requirements of the project into clear technical specifications. The technical baseline also contains significant technical milestones such as completion of scope required to meet regulatory agreements and stakeholder commitments.

Each deactivation activity undertaken to support the project provides information not only in support of decisions to be made but also for other activities during the decision-making process. A schedule for accomplishing these activities should be developed with milestones identified.

The project baseline is the integration of the technical scope, the cost, and the schedule baselines. Each component baseline is measurable and must be established by the end of the full project definition so that the performance can be monitored and controlled throughout the project's life cycle. Tracking performance against the approved baseline allows the use of standard project management performance measurement tools, such as "earned value" to determine the intermediate levels of success toward completion.

4.2.6 Step 8: Issue Project Plan Document

Documentation of the outputs from the various deactivation planning steps allows communication of the objectives, requirements, and constraints to the project organization and documents how the deactivation project is to be carried out. This information is issued to the project organization responsible for the planning and performance of the work tasks required to meet the deactivation end points.

4.2.7 Step 9: Detailed Work Packages

The information contained in the project plan forms the basis for the development of detailed work packages. These specific work packages provide the safety and health requirements as well as the step-by-step instructions to the workers responsible for the conduct of the work to be performed.

As the level of detail improves during project development, detailed work tasks can be developed and scheduled. These tasks should be identified, evaluated, and controlled within the facility's existing job-control system. As indicated in Section 3.2 of this Guide, the principles of integrated safety Management must be an integral part of the work package and job-control system.

To be effective, work packages need to include the following items:

- A description of specific work scope activities.

- Identification of the type of hazard analysis required for the activity and verification that the analysis was performed.

- A method to ensure that hazards associated with each of the planned activities are documented and communicated to workers together with the steps to eliminate, minimize, or reduce the risk of those hazards to an acceptable level.

- Work permits necessary to conduct such work.

- The necessary training requirements to perform each task.

- A listing of specialized equipment and each item's intended use.

- The personal protective equipment needed to limit exposure to the identified hazards.

- The emergency response procedures applicable to the task and the area of work.

- A description of the management structure, including communication and reporting channels.

- Engineering studies applicable to the task.

- The expected results upon completion of the task.

The detailed work packages provide the details of the work to be accomplished and the process for doing such work safely and efficiently. The work packages, also, provide the structure of project activities needed to sufficiently inform all involved parties of the work to be accomplished. This documentation ensures that safety and health impacts have been verified and evaluated and that controls are established prior to commencing work.

As a final step to work package preparation, the planned work activities are evaluated against the potential impact to the safety authorization of the facility. A safety review is conducted to ensure that the work activities are authorized to be performed within the facility's safety envelope. The formality and rigor of this type of process may vary with the existing hazards or the hazard classification of the project or facility. However, a determination of the impact on the authorization basis is essential.

4.3 STEP 10: PROJECT EXECUTION

After the work packages have been developed, the work is performed. Because work execution is highly variable and execution guidance can be found in many other sources, it is described and listed as a single general step in this Guide. The execution phase will have to be continuously revisited both formally and informally, as deactivation work progresses.

This step is performed until the end point criteria are achieved as stated in the deactivation plan. During the conduct of deactivation activities, provisions of the facility's safety and health plans and the technical specification of the deactivation project plan must be followed to ensure that field activities are protective of workers, the public, and the environment. Wastes generated during the performance of deactivation activities must be handled in compliance with applicable regulatory requirements. In addition, DOE's *Pollution Prevention Program Plan*, dated 1996, and *Pollution Prevention/Waste Minimization User's Guide for Environmental Restoration Projects: Decommissioning and Remedial Actions*, DOE/OHG 1320.2A-1, dated March 1998, which provide guidance for developing qualitative and quantitative waste reduction goals, should be considered.

4.3.1 Step 11: Feedback

Project personnel must maintain safety during the deactivation period while conducting the tasks defined in the work packages and performing the remaining day-to-day S&M activities. Integrating the normal S&M activities with the deactivation tasks is critical to maintaining safety. One way to do this is by conducting pre-job briefings, which include the procedures to be used, a review of the hazards and adopted controls, a review of the emergency procedures, and consideration of all of the additional activities ongoing in the facility. This also provides an excellent opportunity to verify that all permits are in place, the emergency response plan is ready for implementation, and personnel have completed the appropriate training to accomplish the activity.

While performing deactivation tasks, project personnel must ensure that hazard controls and work practices are monitored for adequacy. It is necessary to establish a feedback mechanism to provide information on unforseen hazards and to develop corrective actions to mitigate any hazards. The feedback system can also provide an avenue to review completed work activities and assess the need for additional controls or the removal of controls as a result of lowered risks in the facility.

The effectiveness of the feedback system can be ensured with management support and commitment. It is important that project personnel understand their rights and responsibilities related to maintaining safety and health during the course of the deactivation project.

4.4 PROJECT CLOSEOUT

The completion of the deactivation project is determined by verifying that the end state has been achieved and the end points have been met. The end-point closeout formally demonstrates completion and provides the necessary documentation, including the physical and administrative characteristics and current safety and health information to support post-deactivation reviews. This documentation also verifies that quality control and quality assurance provisions have been met.

Facility-specific data contained in DOE's Facility Information Management System (FIMS) is to be reviewed and updated to reflect the facility condition as a result of the completion of deactivation end points.

Closeout of the deactivation project signifies completion of one step in the life cycle of the facility and the beginning of another. Details pertaining to post-deactivation S&M, ownership of those activities, as well as the timing for decommissioning are addressed in DOE G 430.1-2 and DOE G 430.1-4.

4.4.1 Step 12: End-Point Closeout

Facility end points provide the critical link to the success of moving the facility through the deactivation process. It is necessary to evaluate the end points obtained through the deactivation operation to determine if the achieved end points meet those originally planned. A variety of methods may be used to verify the end points, ranging from visual inspections to explicit measurement procedures. A record of the verification method used is included in the project closeout documentation, allowing transfer of this essential information during the transition of the facility into decommissioning.

4.4.2 Step 13: Final Report

Just as the Pre-Transfer Review report documents the condition of the facility at the time of transfer from the operating program to the disposition program, the final deactivation report provides a facility condition status after the deactivation end points have been completed. This report includes S&M recommendations for ensuring the remaining facility hazards are contained and monitored. The post-deactivation S&M should be consistent with the guidance provided in DOE G 430.1-2. At this point in the project, sufficient information should be available to prepare this report with minimal effort.

The intent of the deactivation final report is not only to document the existing condition of the facility but to provide the receiving organization with a clear understanding of the deactivation activities and the results that were obtained. The following elements should be addressed in the final report:

- Project Background. This section documents the facility description and physical boundaries. Descriptions of the deactivation project concept, objectives and scope are helpful in order to better understand the deactivation activities that were completed. This is important in that some number of years may have elapsed in a continuing surveillance and maintenance mode prior to any decommissioning efforts.

- Project Performance. The deactivation project activities are included or referred to in the deactivation project plan and the project results identified. It is important to also describe any issues and barriers that were necessary to overcome and any special management methods required in the performance of the deactivation tasks.

- Project Management. Typical project performance elements such as cost and schedule are summarized. The work breakdown structure used is also helpful in understanding how the deactivation activities were managed.

- Project Safety and Health Management. A summary description of all remaining radiological, industrial, nuclear, and environmental facility hazards must be provided. Any project results directly related to safety are also included.

- Configuration. A list of all existing operating systems and the surveillance and maintenance activities required to maintain the current safety envelope of the facility will be included. The location of all documentation and records such as those that define the authorization basis; the permits, licenses, and agreements that remain imposed on the facility; and the remaining commitments to regulatory authorities, stakeholders and DOE organizations that require action are identified.

- Lessons Learned Summary. As with all projects, it is important to document the lessons learned during the planning and performance of deactivation activities. This information, provided in the final report, assists in planning for the next phase, decommissioning, as well as other deactivation projects at the same or other sites within the DOE complex.

An updated characterization of the facility and the remaining materials contained therein and a revised condition assessment of all structures, existing protective barriers and systems installed to ensure the safety of workers, the public, and the environment, minimizes the effort required to complete the final deactivation report. This information is invaluable in providing the receiving organization with an understanding of the facility's condition; the nature, levels, and probable extent of remaining hazardous chemical and radiological contamination within and around the facility; and an inventory or estimate and the locations of the remaining toxic, hazardous, and radioactive materials.

4.4.3 Step 14: Deactivation to Decommissioning

This step is the boundary between the deactivation phase and the decommissioning phase of the facility's life cycle. Once the deactivating program organization verifies that the project deactivation end state has been achieved and is adequately documented, the receiving organization (usually the decommissioning organization) is identified. Management and financial responsibility of the facility may now be transferred.

Similar transfer reviews, documentation, and memorandums, as outlined in DOE G 430.1-5, may be used in the transfer process (e.g., a report including all project documentation and the use of a signed agreement to document condition, state of readiness, and associated funding for transfer). It is important to maintain the same objective of an integrated and seamless process linking the new decommissioning phase with deactivation as the excess facility is transferred to its next life-cycle phase.

Development of decommissioning activities is discussed further in DOE G 430.1-4.